

Listing of Claims:

This listing of claims reflects all claim amendments and replaces all prior versions, and listings, of claims in the application. Material to be inserted is underlined, and material to be deleted is in ~~strikeout~~ or (if the deletion is of five or fewer consecutive characters or would be difficult to see) in double brackets [[]].

What is claimed is:

1. (Currently Amended) A coupler comprising:

a dielectric substrate having first and second surfaces; and

at least a first coupler section including:

a first spiral including a first spiral portion on the first surface and a second spiral portion on the second surface; and

a second spiral including a third spiral portion on the first surface and a fourth spiral portion on the second surface;

the first and second spirals being mutually inductively coupled, and each spiral having an intermediate portion and end portions, with the width of each of the spirals being different in the intermediate portion than in the end portions.

2. (Original) A coupler according to claim 1, in which the first spiral includes input and output terminals on the first surface, and the second spiral includes input and output terminals on the second surface.

3. (Canceled)

4. (Currently Amended) A coupler according to claim 1[[3]], in which the widths of the spirals are wider in the intermediate portions than in the end portions.

5. (Original) A coupler according to claim 1, in which the first spiral includes a fifth spiral portion on the first surface, the fifth spiral portion being separated from the first spiral portion by the second spiral portion.

6. (Currently Amended) A coupler according to claim 1, in which portions of the first and fourth spiral portions are in ~~parallel~~directly opposing relationship relative to the dielectric substrate and portions of the second and third spiral portions are in ~~parallel~~directly opposing relationship relative to the dielectric substrate.

7. (Original) A coupler according to claim 1, in which the dielectric substrate is less than 10 mils thick.

8. (Original) A coupler according to claim 7, in which the dielectric substrate is less than 6 mils thick.

9. (Original) A coupler according to claim 7, in which the first and second spirals are N quarter wavelengths of a design frequency long.

10. (Original) A coupler according to claim 9, in which the design frequency is between 100 MHz and 10 GHz.

11. (Original) A coupler according to claim 9, in which the design frequency is greater than 1 GHz.

12. (Canceled)

13. (Original) A coupler according to claim 1, further comprising a first ground layer generally parallel to and spaced from at least a part of the first portion of the first spiral, and a first layer of air separating the part of the first portion of the first spiral from the first ground layer.

14. (Original) A coupler according to claim 13, further comprising a second ground layer generally parallel to and spaced from at least a part of the second portion of the second spiral, and a second layer of air separating the part of the second portion of the first spiral from the first ground layer.

15. (Original) A coupler according to claim 13, in which the first ground layer is separated from the part of the first portion of the first spiral by a first distance, the coupler further comprising a second coupler section including a first conductor mounted on the first surface of the dielectric substrate and connected to the first spiral and a second conductor mounted on the second surface of the dielectric substrate and connected to the second spiral, and the first ground layer is spaced from the second coupler section by a second distance less than the first distance.

16. (Original) A coupler according to claim 15, further comprising a second dielectric substrate extending between the second coupler section and the first ground layer.

17. (Original) A coupler according to claim 15, in which the first and second conductors of the second coupler section extend generally in parallel, and each of the first and second conductors in the second coupler section include an intermediate portion and end portions, with the end portions having a width that is less than the intermediate portion.

18. (Original) A coupler according to claim 17, in which the first and second conductors of the second coupler section each further include an extension extending from and transverse to the respective intermediate portion, the two extensions extending in opposite directions.

19. (Currently Amended) A coupler according to claim 1, further comprising an extension extending from coplanar with, and transverse to an intermediate portion of each of the first and second spirals, the extensions extending in mutually non-overlapping relationship.

20. (Original) A coupler according to claim 19, further comprising a first layer opposite the substrate, having a low dielectric constant disposed adjacent to at least a portion of the first and second spirals, and a thermally conductive second layer opposite

the substrate and disposed adjacent to each extension.

21. (Original) A coupler according to claim 20, in which the first layer is air.

22. (Original) A coupler according to claim 1, in which the first and second spirals are substantially in opposing relationship relative to the dielectric substrate.

23. (Original) A coupler according to claim 1, further comprising a second coupler section including a first conductor mounted on the first surface of the dielectric substrate and connected to the first spiral and a second conductor mounted on the second surface of the dielectric substrate and connected to the second spiral.

24. (Currently Amended) A coupler according to claim 23, further comprising a second dielectric substrate extending between the second coupler section and [[the]]a first ground layer.

25. (Original) A coupler according to claim 23, in which the first and second conductors of the second coupler section extend generally in parallel, and each of the first and second conductors include an intermediate portion and end portions, with the end portions each having a width that is less than the intermediate portion.

26. (Original) A coupler according to claim 25, in which the first and second conductors of the second coupler section each further include an extension extending

from and transverse to the respective intermediate portion, the two extensions extending in different directions.

27. (Currently Amended) A spiral hybrid coupler comprising:
a dielectric substrate having opposing first and second surfaces; and
a first conductor having first and second ends and forming a first spiral between the first and second ends; and
a second conductor having third and fourth ends and forming a second spiral between the third and fourth ends;
the first and second conductors being disposed on opposite surfaces of the substrate, the first and second spirals each including a first spiral portion on a respective one of the first and second surfaces and a second spiral portion on the respective other of the first and second surfaces; and
the first and second conductors having widths, and the widths of the first and second conductors in the second spiral portions are different than the widths of the first and second conductors in the first spiral portions.

28. (Original) A coupler according to claim 27, in which the first and second ends are on the first surface and the third and fourth ends are on the second surface.

29. (Original) A coupler according to claim 27, in which the first and second spirals include a third spiral portion on the respective one surface, the respective second spiral portion being electrically between the respective first and third spiral

portions.

30. (Currently Amended) A coupler according to claim 29, ~~in which the~~
~~conductors have widths, and~~in which the widths of the first and second conductors in
the second spiral portion are wider than the widths of the first and second conductors in
the first and third spiral portions

31. (Original) A coupler according to claim 29, in which the first and second
conductors each include an extension extending from and transverse to the portion of
the associated conductor forming the second spiral portion, the extensions extending in
mutually non-overlapping relationship.

32. (Original) A coupler according to claim 27, in which the dielectric substrate
is less than 10 mils thick.

33. (Original) A coupler according to claim 32, in which the dielectric substrate
is less than 6 mils thick.

34. (Original) A coupler according to claim 32, in which the first and second
spirals are N quarter wavelengths of a design frequency long.

35. (Original) A coupler according to claim 34, in which the design frequency is
between 100 MHz and 10 GHz.

36. (Original) A coupler according to claim 35, in which the design frequency is greater than 1 GHz.

37. (Original) A coupler according to claim 27, further comprising a first ground layer generally parallel to and spaced from at least a part of the first portion of the first spiral, and a layer of air separating the part of the first portion of the first spiral from the first ground layer.

38. (Currently Amended) A coupler comprising:
a dielectric substrate having opposing first and second surfaces; and
a first conductor on the first surface and having first and second ends; and
a second conductor on the second surface and having third and fourth ends;
the first and second conductors forming a first coupled section including an intermediate portion and end portions, with each of the end portions having a width that is different[[less]] than a width of the intermediate portion.

39. (Currently Amended) A coupler according to claim 38, in which the first and second conductors of the ~~second coupled~~ first coupled section each further ~~include~~ includes an extension extending from, coplanar with, and transverse to the respective intermediate portion, the two extensions extending in non-overlapping relationship.

40. (Original) A coupler according to claim 39, in which the two extensions

extend in opposite directions.

41. (Original) A coupler according to claim 39, in which the two extensions include a narrow proximal portion, and a broad distal portion.

42. (Currently Amended) A coupler according to claim 39, in which the first and second conductors further include an uncoupled section adjacent to the coupled section, the first and second conductors extending in opposite directions in the uncoupled ~~direction~~section.

43. (Original) A coupler according to claim 42, in which the first and second conductors further form a second coupled section, the uncoupled section being positioned between the first and second coupled sections.